Embodied Virtual Reality
Limits and applications

Dr Bruno Herbelin

Laboratory of Cognitive Neuroscience
Center for Neuroprosthetics
Brain & Mind Institute
EPFL
We can only experience the world from the perspective of our body.

Virtual Reality Embodiment allows experiencing the world from the perspective of another body.
VR Embodiment via 1PP + Visuomotor Synchrony

Mel Slater, University of Barcelona
What are the conditions and limits of VRE?

Research work by Ronan Boulic (Immersive Interaction Group, EPFL) and Bruno Herbelin (LNCO, EPFL)
Physiological measure of Presence
Fear induction in the virtual pit room

Measure of fear with physiological sensors (GSR, ECG) shows high reaction to fear of height
Comparing First & Third Person View
Voluntarily alternating First & Third Person View
Voluntarily alternating
First & Third Person View

Questionnaire result

Strong embodiment in congruent visuo-motor-tactile condition for both 1\textsuperscript{st} and 3\textsuperscript{rd} P. view

Galvanic skin response to threat

Alternating views can combine the advantages of both
Self-Attribution of Distorted Reaching Movements
Self-Attribution of Distorted Reaching Movements

Helping reaching movement is good and not easily detected
Hindering movement is critical

speed gain = \frac{speed_v}{speed_p} - 1
Reconciling Being in-Control vs Being Helped

BLOC 1 - Self-attribution Threshold
BLOC 2 – Progressive Distortion

Porssut et al. – Accepted IEEEVR 2019
Reconciling Being in-Control vs Being Helped

Results (N=24)
Self-Contact Visuo-tactile Congruency is stronger than Agency
Self-Contact Visuotactile Congruency

Self-Touch is critical, And more important than agency
Changes in body representation lead to changes in perception, attitudes and behavior

Examples from eventLab
Prof. Mel Slater
Barcelona University
Becoming a Child

Just a few moments of multisensory stimulation leads to changes in size perception and self-attributions.

Groups:

- **Adult**
- **Child**

![Graph showing size perception comparison](image)

N=32

Both groups overestimated the sizes of objects. Those in the child group double overestimated.

Banakou, Groten, Slater (PNAS, July 2013)
Transforming the Self into a Child

Domna BANAKOU¹, Raphaela GROTHEN¹, Mel SLATER¹,²,³

¹ Facultat de Psicologia, Universitat de Barcelona, Barcelona, Spain
² Institucio Catalana Recerca i Estudis Avançats (ICREA), Universitat de Barcelona, Barcelona, Spain
³ Department of Computer Science, University College London, London, United Kingdom
Putting yourself in the skin of a black avatar reduces implicit racial bias

Experimental conditions:
- Embodied-Light-Skinned (EL)
- Embodied-Dark-Skinned (ED)
- Non-Embodied Dark-Skinned (ND)
- Embodied-Alien-Skinned (EA)

Banakou, Groten, Slater (2013) PNAS
Note
Implicit Association Test (IAT)

If ‘Black’ are faces paired with negative words and ‘White’ faces with positive words faster than the other way around, this shows an [implicit] bias.

Note this does not mean that the person is prejudiced but reflects [implicit] bias (which may be socially determined)

See [https://implicit.harvard.edu/implicit/demo/](https://implicit.harvard.edu/implicit/demo/)
Repetition study - embodiment of White people in Black body reduces implicit bias?

- Between Groups Design: 3 groups
  - 1, 2, or 3 exposures, each separated by 3 days
- IAT measured 1 week before 1st exposure
- IAT measured 1 week after last exposure

- Diminution lasts at least 1 week after the end of the exposure
- One exposure is sufficient to observe this effect

Banakou, Parasuram D, Slater (2016) Front. Human Neuroscience
Self Counselling

Basic idea: talking with yourself as if with another person could be helpful for personal problem solving.

Conversations between Self and Self as Sigmund Freud

A Virtual Body Ownership Paradigm for Self Counselling
Potential social impact

Observation on violence of soccer supporters: identification with the victim (supporter of same club) leads subject to want to help

Application against domestic violence: rehabilitation of offenders by embodiment into a woman’s body

Work led by Dr Mavi Sanchez-Vives with Justice Dept Catalonia

Mel Slater, University of Barcelona
Synthesis

• Technologies for Virtual Reality Embodiment are available and effective

• Embodiment is robust to
  • Change of perspective
  • Movement distortion
  • Various appearance
  • Change of body

• Experiencing being in a different body impacts our perception and judgement of the world
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Campus Biotech
Chemin des Mines 9
CH-1202 Genève
Switzerland